Final Report (First Year Grant)

Grant AOARD-10-4030

## "Effects of Cognitive Load on Trust"
November 2011

NICTA

## Executive Summary

This report summarizes the research activities undertaken as part of the "Effects of Cognitive Load on Trust" project in conjunction with the US AFRL and Sunway University. NICTA's role comprised the measurement and assessment of cognitive load through speech and other interaction modalities. The project initially involved examining whether the relationship between cognitive load and trust judgments had been examined in the literature. A synthesis of this effort is detailed in the first section of this report.

The second major milestone in this project was the completion of the planning and design of the user study for all three sites (US, Malaysia and Australia), including coordinating multi-national IRB approval for the experiments. The third milestone involved the implementation of the software for data collection, and the production of supplementary materials to be used in the study. The outcomes for this part of the work are described in the second section of the report. The execution of the study was divided into three data collection phases, one for each site (Australia, US and Malaysia). The Australian user study has been completed, with approximate 100 university students sampled and analysis is underway. A summary of the data collection outcomes so far is also included here.

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**This report covers results of two research tasks: (1) evaluating the relative strength of Mayer?s trustworthiness indicators in both a collectivistic and individualistic culture; (2) examining the relationship between cognitive load and trust.**

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# 1. Introduction

Trust is found to be a critical factor driving human behavior in both interpersonal and computer-based interactions. Previous research by Mayer et al. [1] has found three trustworthiness elements that influence the development of trust in interpersonal situations: ability, benevolence, and integrity. Thus far, only a few studies have looked at how different situational factors influence trust development as reflected in the relative salience of the three trustworthiness indicators. One dominant situational factor that may shape trust perceptions of an information source is culture. Similarly, little is known how cognitive load may affect the different trustworthiness factors during trust development and acquisition.

The 3-year research project proposed serves as part of a larger international research effort in collaboration with Dr. Lyons and Dr. Stokes (AFRL), and Dr. Yeo (University of Malaysia Sarawak), with separate proposals to be submitted through the AFOSR/AOARD programs. A three-part user experiment was designed - one in the US, one in Australia, and one in Malaysia, to investigate the cross-cultural influences on trust. The Australian part of the data collection has been completed thus far, with the US and Malaysian counterparts currently in progress.

# 2. Project Plan Updates

The following project plan was agreed to as part of the grant approval for the first year of this project. No significant amendments have been made to this initial plan. At the end of the first year, milestones M1- M4 are complete, while M5 is in progress and the project is running on time. This document details our progress.

| ID | Milestone | Deliverable/Outcome | Due Date |
|----|-----------|---------------------|----------|
| M1 | Complete Pre-Pilots (Materials) | • Pilot test the neutrality of the stimulus data to be used in the experiment<br>• Stimulus material in target demographic (Australian)<br>• Make changes to the stimulus material as appropriate to ensure neutrality | Jul 30, 2011 |
| M2 | Experiment Tool Design | • Development of the experimental application to be used<br>• Implement factor manipulations, including cognitive load<br>• Implement data collection functionality as part of the design | Aug 31, 2011 |
| M3 | Complete Pre-Pilots (Study Design) | • Conduct pilots on target demographic (6 participants)<br>• Evaluate study design, procedure, physical set-up | Sep 30, 2011 |

| | | • Assess changes needed at each site | |
|----|------|------|------|
| M4 | Complete Experimental Study | • Source participants<br><br>• Run the study<br><br>• Debrief participants | Nov 30, 2011 |
| M5 | Signal Analysis of Speech Data | • Collect speech data from other sites<br><br>• Segment, annotate and label speech data<br><br>• Build speech models to represent cognitive load levels.<br><br>• Report results to rest of the team | Jan 31, 2012 |
| M6 | Linguistic Analysis of Speech Data | • Prepare speech annotations<br><br>• Run linguistic analyses on text data derived from speech | Mar 31, 2012 |
| M7 | Consolidate Speech/Linguistic Findings | • Ground truth analysis (subjective ratings, performance)<br><br>• Contextualise the findings with those from Trust based manipulations, looking for interaction effects | Jun 30, 2012 |
| M8 | Project Management | • Weekly meetings<br><br>• Team workshops, including conference calls with co-investigators<br><br>• Year-end final report circulated to AOARD office and all other investigators | Jun 30, 2012 |

# 3. Literature Review

The proposed research will evaluate the relative strength of Mayer's trustworthiness indicators (ability, benevolence, and integrity) in both a collectivistic and individualistic culture. To date, there have been no such studies that have empirically tested this model in different cultures. Additionally, the research will examine the relationship between cognitive load (CL) and trust characterized by the trustworthiness indicators, and whether this CL-trust relationship is affected by cultural factor.

*Cognitive load and trust*: Cognitive load is a key component of the four-stage model of human information processing [8], and it is clear that, like trust, it plays an important role in mediating human behavior during collaboration with other humans or automated systems.

Despite this, little is known about the relationship between the two in such contexts. Intuitively we might guess that as cognitive load increases, a person may choose to rely more heavily on colleagues or an automatic system and in the process display more indicators of an implicit trust of the system. Alternatively, under higher load the person may be reticent increase their trust and instead adapt their strategy to manage the increased task complexity to avoid increased dependence on others or on an automatic system. Although the authors note that the empirical evidence is limited, Parasuraman and Riley [9] argue that increased workload is often cited as one of the most important factors in choice to use automation. However, in a comparison of trust in various levels of automation, including manual control, Ruff and colleagues [10] found that as workload increased, subjective reports of trust decreased for automation, but increased for manual control. In an explanation for the equivocal evidence for trust and automation use, Parasuraman and Riley [9] suggest that complex task domains may prompt different task strategies, such as use of automation during high cognitive load even if trust is low. Thus, under high cognitive load, use of automation and trust (subjectively measured) may not be aligned, as is often assumed. The proposed study seeks to clarify the equivocal results of previous research through the examination of the fundamental trust process (i.e., not simply use of automation) under varying levels of cognitive load.

Previous investigation of the effect of cognitive load in user interfaces suggests the entrenchment of established behaviors with increasing load [11]. Other research also suggests that with increased cognitive load users revert to older, over learned and simpler types of responses [12]. When a user has a pre-existing trust of an automated system, the implication is that they will tend to over-trust the system during higher cognitive load [13], and a similar result might be expected of another human agent rather than a system. The Affect Infusion Model [14] suggests that during faster processing, individuals use their affective states as a short-cut to infer their evaluative reactions to a target, such as in judgments of trust. Thus, it is likely that similar reliance on established cultural values and attitudes may rise to the surface during higher cognitive loads. With respect to the elements of trustworthiness, it has been found that action-oriented and performance-oriented cultures put more value on a party's ability, while collaborative and relationship-oriented cultures emphasise more on the party's benevolence.

Based on the theories proposed by Lee and See [15], and Mayer et al. [1], an initial conceptual model of trust developed by Dr. Stokes (AFRL) for our further research is shown in Figure 1. In this model, trust is an attitude that drives behavior through intention. While trust is affected by the trustworthiness indicators perceived under the influence of various cognitive load levels, at the same time, cognitive load is affecting behavior as a main cognitive constraint using competing resource in the mental space. Due to the error feedback loop of past experience, trust can also be affected dynamically by the fluctuation in cognitive load.
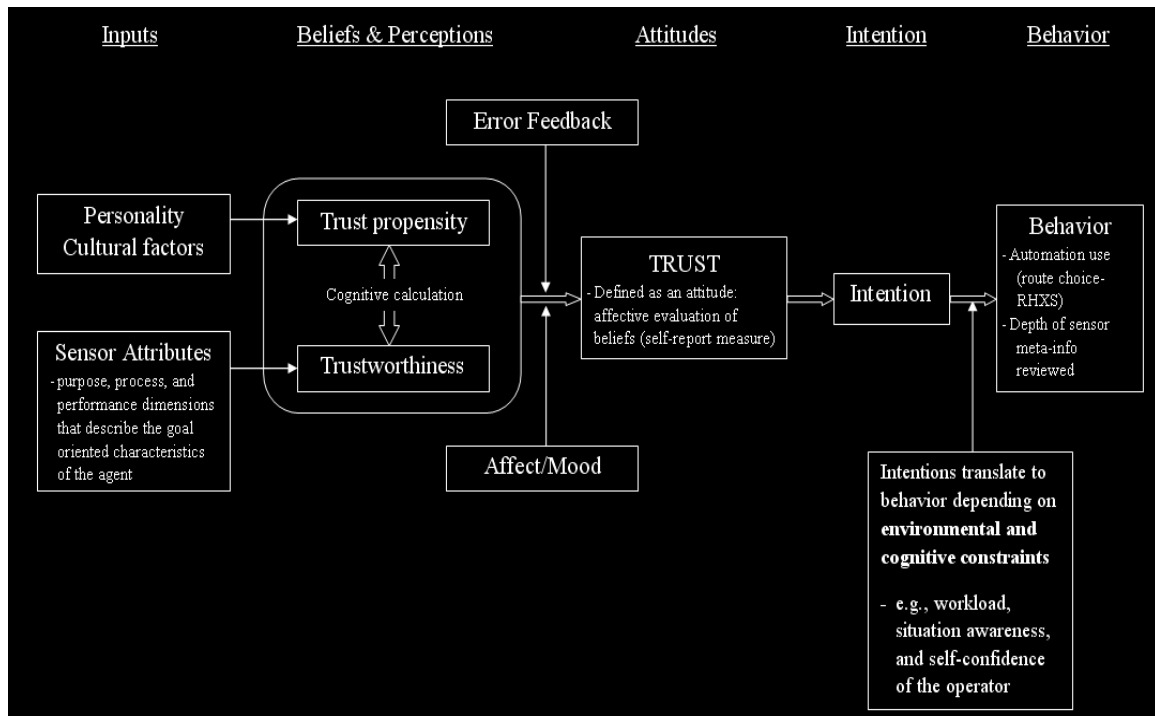
Figure 1: Proposed conceptual model of trust

Based on the literature review conducted by the team, to the best of our knowledge, there are no prior studies that attempted to investigate any relationship between trust and the construct of cognitive load in detail. A few studies have attempted to isolate the effects of high workload and stress on the level of people's trust judgements but their focus was more on the people's trust perception of organisations and of automation systems, e.g. Mayer and Davis (1999) [2], and Biros, Daly, and Gunsch, (2004) [14]. The former study showed that when good performance is overlooked by an appraisal system in a job environment, employees develop a lack of trust in their employer. On the other hand, when they felt that the appraisal system was fair, their trust for top management increased and they regarded integrity as the most important factor for this trust perception. The study was based on the standard elements of trust and trustworthiness, i.e., the ability, benevolence, integrity, and trustors' propensity as proposed by Mayer et al in 1995 [1]. In the second example, Biros, Daly, and Gunsch, 2004 [17] presented a study where the objective was to see how people's usage of and dependence on system automation (in other words their trust in system) changes when they experience high task load, especially under information uncertainty situations. It was found that when task load (and hence cognitive load) increases, people continue to rely on the (interaction and decision support) system, even if they have less trust in it. Under high load and critical task situations, it has also been found that people trust the system more when the system behaves in a polite manner and depicts accepted etiquette norms. People also show increased trust in the system when the system shows and maintains its reliability and dependability.

While many of these studies that did try to find a relationship between trust and workload, failed to provide a detailed account of the relationship. Namely, the question of how various levels of cognitive load would affect the trust perception or trustworthiness still remains to be answered. With emerging technologies being available for real-time, automatic, and non-intrusive measurement of cognitive load, this could provide a new dimension into understanding trust judgements in work situations, or during complex problem solving.

# 4. User Study Design and Materials

## *Hypotheses*

As a first step to gain insight into relationship, we can pose the following hypotheses concerning the interdependence of cognitive load and trust:

1. For a fixed level of trustworthiness, increasing the task complexity (implicitly cognitive load) will affect both the likelihood of a person to rely more heavily on others and the degree of trust they invest in them.

2. For a fixed level of task complexity, varying the trustworthiness of others will affect both the likelihood of the person to rely more heavily on them and hence the degree of cognitive load they perceive during the task.

3. High cognitive load situations are more likely to affect trust judgements that rely on accurate assessments of ability and possibly integrity aspects – since these have been classified as cognitive rather than affective processes during trust judgements.

4. Cultural factors can affect the interdependence of cognitive load and trust, such that cultural biases in trust will be exacerbated under high cognitive load.

## *Design: Independent Variable and Repeated Measures*

To produce higher cognitive load tasks, a dual-task paradigm was employed. Subjective ratings of complexity and difficulty were employed after each task set, to ensure that the desired levels of load built into the task design were actually being perceived by the study participants. The full set of all experimental conditions for a given cultural factor can be seen in Table 1.

Table 1. Examination of interdependence between trust and cognitive load: experimental conditions.

| | | Trust/Trustworthiness | |
|---|---|---|---|
| | | Low | High |
| Cognitive load | Low | Single task, low induced trust | Single task, high induced trust |
| | High | Dual task, low induced trust | Dual task, high induced trust |

In terms of cognitive load measurement, the pair of high-trust tasks allows a 'control' condition, where we expect to see variation due only to high cognitive load that matches previously observed results (e.g. [6]). The task design ensures that multiple methods of cognitive load measurement are made, in particular, recordings of participants' speech and logged keystrokes/mouse movement (behavioral measure) and the aforementioned self-rating (subjective measure). The present study will use a 2 (cognitive load, w/n) x 3 (AIB indicators, w/n) x 3 (culture, b/w) mixed design.

All subjects will need to complete both load conditions (low and high load) in a repeated measures design because the implicit load measures are dependent on a baseline to high load

comparison. Expected changes in recorded behavioural data features of load will trend one way (e.g. increased pauses in speech during think-aloud of high load tasks) .

## Experimental Platform

The experimental platform simulates a computer-based applicant screening process called the "Human Resources Applicant Selection Tool". Participants were told that they were participating in a user evaluation of a new virtual interview tool being considered for a business application.

Participants assessed potential job candidates and review the applicants' virtual resume which includes standard experiential data (i.e., education, previous experience, skills, etc.), interest statements, and referential data provided by previous supervisors. The aim was that the application would have a similar look and feel to that of Facebook. After several design discussions, story boarding and wireframe iterations, the final application was produced and is illustrated in Fig.2 -18. Candidate applicants' ability, integrity, and benevolence (AIB trustworthiness indicators) were manipulated through referential data inserted into the tool as well as through narratives provided.   Each applicant was described by previous supervisors or co-workers as being high or low one of the trustworthiness indicators. Examples of vignette-like descriptions of the trustworthiness indicators from previous research (see Mayer & Norman, 2004) were adapted for use in the current study. Four applicants were presented for each session: 1 high benevolence subject, 1 high ability candidate, 1 high integrity candidate and 1 negative candidate on all three aspects.

For the cognitive load manipulation, a secondary monitoring task was introduced, known as the notification feature, which allowed subjects to receive and "queue" new incoming resumes and applications to be "processed later". This was presented as an additional feature of the tool – and participants were asked to complete two sessions of the task set, with and without the notification feature. The candidates provided in each round were different instances, but represented the same AIB manipulations such that the entire task was exactly the same except for the notification feature.

## Pre Screening Survey and Training

The pre-screening survey was implemented using Survey Monkey, over the web. It consisted of 13 questions with 91 items altogether. The full Pre-Screening survey used can be found in the Appendix to this document.

The training video was a 6-minute animated instruction manual on how to complete the tasks.  Some still shots of the storyboard of the video have been included in the Appendix also.

## Task Structure

In each session, the first part involved participants filling out a mood questionnaire to ascertain how they left at that moment, to be able to check later whether their current emotional state affected their judgment of the candidates. Participants were asked to select their level of emotion for a number of different emotions, along a semantic differential scale, ranging from "Not at all" to "Extremely",  using radio buttons. As they were completed, a green tick appeared at the end of the row, denoting the question has been answered.

**Figure 1 : Initial Mood Survey**

Immediately following this, three subtasks were performed on the available candidates.

## Subtask One: Screening Candidates

After reading a brief vignette about each candidate applicant, participants were asked to rate their degree of trust for each. The first subtask consisted of answering a series of survey questions about the candidate by clicking on a radio button on a semantic differential scale, as to whether they agree or disagree with a statement being made in relation to this candidate applicant. One by one, they were asked to review the candidates under each of the four tabs on the screen, paying particular attention to the comments included in each section (Education, Experience and Volunteer Experience and Personal Interests, as seen in Fig. 2).

The comment areas were formatted to stand out on the profile page, and the rest of the applicant information was very similar for all candidates (e.g. most had around the same amount of experience and education). Essentially, the differentiators could only be found in the comments from previous employers, supervisors and peers for that candidate – this was where the AIB manipulations were made. Additionally, the applicants were "anonymous" – they were given code names such as "Applicant 68K" to avoid any bias that may be introduced in the participants upon learning the candidate's name. Icons were used instead of photographs also to avoid any bias relating to the candidate's appearance.

**Figure 2 : Applicant Vignette including Education, Experience and Personal Interests.**

As the participant completed the survey questions, a green tick mark appeared at the end of each row, signaling to the participant that that question had been filled in, as seen in Fig. 3. Once all the questions on each page were filled in, and all green ticks appeared on the right hand side of the table did the "Next" button become activated, to allow the participant to continue moving onto the next page.



**Figure 3: Green ticks showing  progress through the survey screening questions**

## Subtask Two: Filling Candidates into Positions

Once the subject completed the review of all four applicants individually, they were asked to bin the applicants in three categories: 1) decision/action oriented - whom the participants would most trust as their boss, 2) relationship oriented - whom the participants would most trust as their friend/colleague, and 3) judgment oriented - whom the participants would most trust to be someone else's supervisor (but not the participant themselves).



**Figure 4: Fill Positions for Supervisor, Co-worked and Other's Supervisor**

Figure 4 shows the second subtask, filling in the positions of supervisor, co-worker and colleague from the available candidates. In order to facilitate this, summaries of the candidates profiles were presented on a single page, each showing the information in the "comment" areas of the individual profiles in the previous subtask. The profiles were presented in the same order as the tabs in the previous subtask, but arranged on a grid from top to bottom and left to right.

The candidate profiles could be dragged to the positions shown on the right hand column of the window, as the participant chooses. Once the candidate is dragged to a position, the profile summary is greyed out  to indicate that profile cannot be chosen for any other position. The participants were also required to fill in some information about how confident they were that they were choosing the right person for the position, along a semantic differential scale of 5 points using a drop down box, from "Extremely confident" to "Very little confidence" in their choice for this position.

**Figure 5 Filling in a candidate for a Supervisor position, with moderate confidence.**

Once all positions are filled (since there are three positions, only three out of four candidates can be selected), the continue button is activated, as seen in Fig. 6 and the participant is then asked to type in a justification for their choice. A pop up dialogue box is provided for this purpose, and allows the participants to explain their reasons for choosing each candidate for each role, and why they judged them to be the best fit. Once their reasons have been typed in, they can hit the Save button on the dialogue box and move on to the next subtask. This is illustrated in Fig. 7.



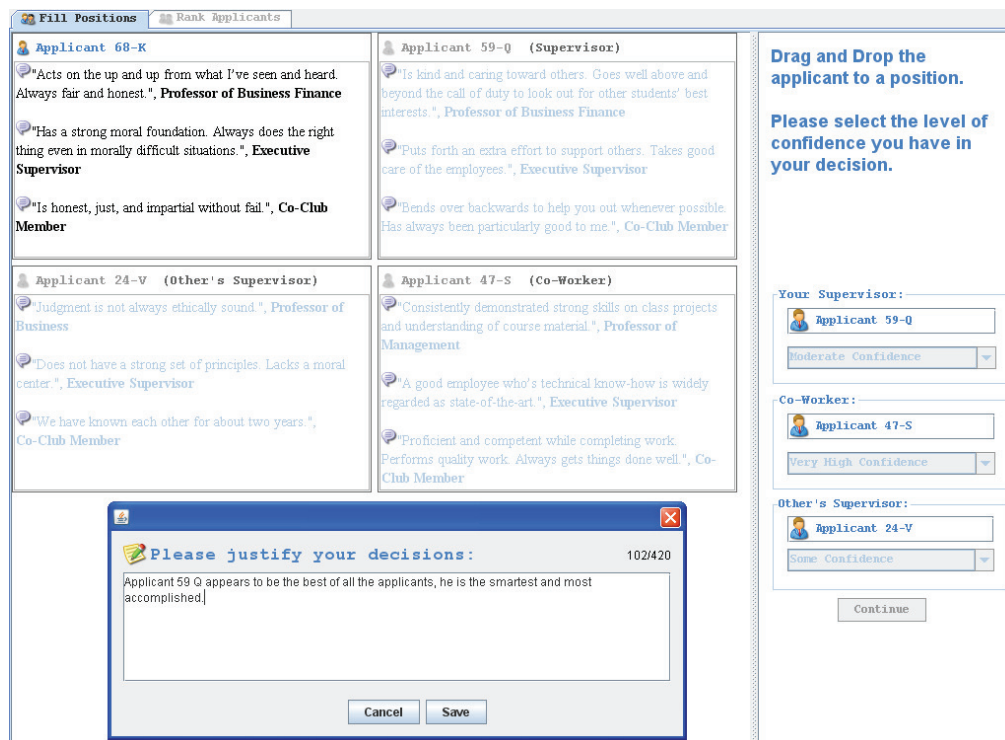**Figure 6 : All positions filled, Continue Button is activated.**

**Figure 7: Justification Pop-Up Dialogue Box**

## Subtask Three : Ranking Candidates

The last subtask involves ranking the candidates in terms of suitability for each position. This means that all four candidates are placed in order from most suitable to least suitable *for each position*. The rankings are made for Supervisor, Co-worker and Other's Supervisor in that order, as can be seen in Fig. 8, 10 and 11. Once all candidate profiles have been ranked, the "Continue" button is activated and the participant can move on from this subtask.
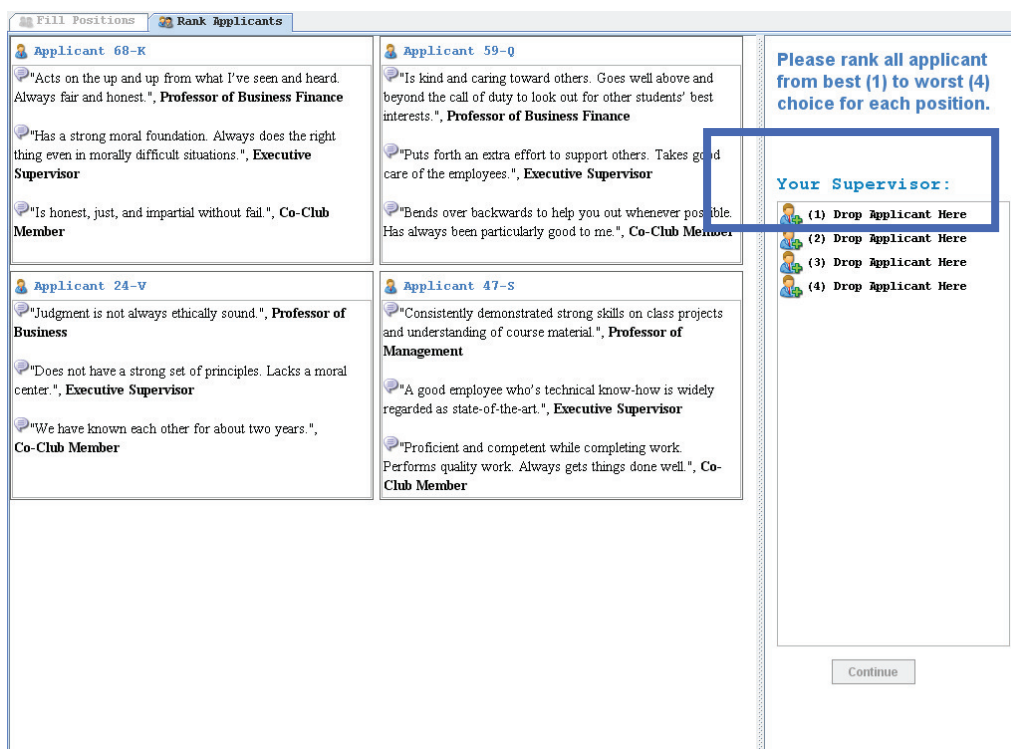


**Figure 8 : Ranking for positions - Supervisor**

**Figure 9 : Ranking for Positions – Supervisor, with initial selections filled**



**Figure 10 : Ranking for the Co-worker/Colleague position**

**Figure 11 : Ranking for the Other's Supervisor position**

## Task Review

The final section is a Task Review, where some metrics are provided about the number of applicants that have been rated, selected for positions and ranked in the above tasks. The "Future Tasks Queued" section is only used in the high load 'round', where the Notification feature is activated. The participants final score will be shown here, namely, the number of "Human Resources" notifications were spotted and added to the queue.



**Figure 12 : The Task Review window**

At the end of each round, the participants were asked to rate on a Likert scale, with a radio button, how difficult they found the session. We expected that they would rank the session

with the Notification feature to be relatively more difficult than the session without the Notification feature.



**Figure 13 : Subjective Difficulty Likert Scale**

Fifty-percent of subjects completed the low-load session first, while the rest completed the high load session first. An instruction appeared before the participant started the high load session, reminding them of how they were expected to handle incoming notifications, as in Fig. 12.. This was a single snapshot recap of the training video, where the whole procedure was shown of spotting and queuing incoming notifications was explained.



**Figure 14: Instruction indicating that the Notification feature would be used in this Session.**

The subtasks to be completed in notifications would appear periodically, for 5 seconds at a time, at the bottom right hand corner of the screen during the entire session. The following format is used:



**Figure 15: Notification Item**

The incoming notifications would be labeled as belonging to different departments, such as Recruiter, Finance or Human Resources for example, as can be seen in Fig. 15 and Fig. 16. The participants were asked to ignore all notifications, except those addressed for "Human Resources". The participant has 4 seconds to click on the notification item, which would bring up a task list, to be populated with "Human Resources" notifications. Once selected, the item could then be added to this list at the end of the queue. Participants could also choose to refrain from adding the item onto the list by simply closing the window.

If the participant missed adding "Human Resources" notifications, or incorrectly added notifications from other departments, the border of the notifications would change from green to amber to red, to indicate that the participants should pay more attention to the notifications. When a sufficient number of "Human Resources" notifications are added to the list  again, the borders on new notifications will appear green once again.

The number of correct additions overall is tallied throughout the session and a final score is given at the end, in the Task Review.



**Figure 16 : A Notification  appearing for a Recruiter.**

**Figure 17 : Adding a Notification for Human Resources to the Task List (queue)**



**Figure 18 : The Notification Item has been added on to the Task List (queue)**

**Figure 19 : Notification item in the Ranking subtask**

## *Modalities and Data Streams*

A number of modalities and data streams have been collected in this experiment. The Experimental Platform described in the previous section was developed in-house, that incorporates all data collection, in both versions (high CL and low CL).

1. Survey Responses
   - **Pre-Screening Survey**
     A pre-screening survey consisting of 13 questions, with a total of 91 multiple choice questions about the participant's attitudes towards their supervisors and peers, honesty, kindness and trustworthiness, as well as some self-identifying ethnicity and personality based questions.
   - **Mood Survey**
     This single question survey required participants to rate a series of affective aspects, such as happiness and sadness, according to how intensely the feeling was being experienced at the time.
   - **Subjective ratings of mental effort/ task difficulty**
     This single question survey asked participants to rate how difficult the tasks were. It was administered at the end of both the high load and low load sessions.

2. Behavioural Measures
   - **Speech: think-aloud protocols**
     Participants were asked to verbalize their thought processes as they work through the three subtasks. These utterances were recorded.
   - **Justification Text**
     Typing behavior of justification for filling positions, the text provided will be analyzed for temporal and linguistic elements.
   - **Mouse trajectories**
     These are in the form of (x,y) coordinates, and are sampled with enough resolution to reproduce the entire experiment session. The trajectory data will be used to track widget manipulation and log use of the mouse as a placeholder or pointer by hovering over specific areas of the application window. They can also provide an indication of attentional focus.
   - **Other interactive behaviors**
     Application level behaviors such as false starts in answer selections, changes in selections, etc have been collected and will be analyzed.

3. Performance Measures
   - **Ratings, Filling positions and Rankings**:
     The final responses to the actual subtasks.
   - **Time-to-completion**
     Overall and per task.
   - **Performance on secondary task:** Number of notifications correctly added, time-to respond, erroneously added notifications items, errors avoided before adding erroneous items.

## *Procedure*

The consent forms were presented to each participant (see Appendix: Consent Forms) a few weeks before the study took place. Participants were assigned randomly to complete a specific experimental condition (high or low cognitive load) first. In the Australian data collection procedure, due to time constraints, participants would go on to complete a brief background survey online (see Appendix: Pre Screening Survey), in the week following the experiment. However, at the other sites (Malaysia and Australia) the students will complete this background survey immediately before the study begins.

The experimenter instructed each participant to sit at a specific computer station and to watch the training video, which explained the purpose of the tool (the script can be found in the Appendix). The training content will be couched as the examination of a new applicant screening HR tool used to rate job applicants. An experimenter or research assistant was be present throughout the entire training and participants could ask questions at any time. No practice trial was provided since use of the system was demonstrated in the video.

Once the participants were ready to begin, they started the application and submitted their student identifier to begin. At this point, they completed the mood survey. Depending on which session (high or low load) they were completing first, the Notification feature instruction screen appeared to remind them that they need to queue notifications. The participants were then presented with the first subtask: screening applicants. Additional surveys will be administered throughout the task and at the end of the task .

Due to time constraints, participants were debriefed the following week, during their tutorial. To further the participants' learning, an exercise was provided for them in relation to interface evaluation and methodology of experimentation, which were topics covered in their course (see Appendix: Debriefing and Exercise).

# 5. Operational Processes

## *IRB Approvals*

All Australian team members (Fang Chen, Natalie Ruiz and Asif Khawaja) have completed CITI training and have received their certificates. Refersher courses must be completed every year and a new round will be required in December.

NICTA applied for Federal Wide Assurance (FWA) and received word of approval in July 2010 after a process taking several months. NICTA also completed the DoD Addendum following this approval, where NICTA formally acknowledged the requirements to follow IRB directives. An IAIR was also needed from which indicated that UNSW Ethics Committee would oversee NICTA research at the Australian site. In fact, NICTA's local data collection and user research approval had already been granted by UNSW Ethics Committee (Ref: 08/2010/42) in July 2010 and will last until September 2013. This approval has also been ratified by the University of Sydney Ethics Committee (Protocol: 14031) in July 2011. All documentation

Finally, cover letters and IRB package for "Trust Management Studies" were submitted to the AFRL IRB including the User Study design and supporting documentation and approved on (Approval 11-21) the 11th June 2011.

## *Pilots Surveys*

The cognitive load manipulations to be used will be determined through pilot testing for feasibility with the overall study design. Pilot studies were conducted to ensure that the manipulations are effective and that all other applicant information is considered equivalent across load levels and across cultures. Since two rounds of the experiment would need to be completed – the amount of stimulus material needed to be doubled also. Appropriate language will need to be tested for each site to test cultural fit. To address these concerns the following pilot surveys were planned and conducted:

Cultural appropriateness of language and bias of trust manipulations: One pilot planned at each site (Malaysia, Australia and US) of 50 subjects of a similar background to the test group (university students). This content pilot, in the form of a web survey, was deployed through SurveyMonkey (can be found in the Appendix). The researchers for each site carefully modified the content to ensure that no bias would be present in or between the candidate profiles that would allow differentiation other than through the AIB indicators – for example, at the Australian and Malaysian sites, the word "college" is seen as less prestigious than the word "university" while in the US, the words are interchangeable. Similarly, some sentences that were to be used as neutral comments could be interpreted as negative comments in Australian culture. For example, if a recommendation for a candidate reads "I have known this person for 2 years", the implication is that there is nothing positive to say about the person except the length of time they have known each other. Other idioms such as use of "above and beyond" and "state of the art" could cause comprehension issues outside of the US.

The US site collected 60 responses to their version of the pilot survey, and the Australian site managed to collect the responses of 30 participants from the University of NSW Human Computer Interaction students. The Malaysian site has yet to administer their content survey at the time of writing.

## *Pilot Experiments*

Various sets of pilot experiments were also undertaken in Sydney and in Dayton, with research assistants. This helped to evolve the experimental software, as well as the UI design and calibrate the secondary task speed and specifications.

It was found that the "think-aloud" protocol added an element of uncertainty in terms of time – as it was found participants would vary in the amount of speech and the depth of explanation they provided. Some participants finished each session in 20-25 minutes, while others took almost 90 minutes. Additionally, during the pilot experiments, it was decided to reduce the number of candidates used in the experiment session from 6 to 4. This reduction allowed some regulation of the timing of the study, preventing subjects from taking too long and being exhausted at the end of the session. We also provided an extra incentive to the participants of a prize for the participant in every session who was able to most consistently speak throughout the session.

## *Participants and Consent Forms*

A total of 120 subjects were planned for the user study per site. The study duration will be approximately 1 hour. Including pilot studies, a total of 360 subjects will be recruited to participate across the three study locations. Participants can either volunteer to participate (e.g., military personnel), receive course credit at the respective university, and/or receive

remuneration in the amount of $20 (or local equivalent) for each 60-minutes of participation, which is the estimated duration of the study.

In the Australian study, 100 students from the INFO3315 course (Human Computer Interaction) at Sydney University, agreed to participate. The consent forms are attached in the Appendix of this document. Of these, 97 completed all sections of the study. The students received course credit in exchange for their participation, as well as snacks and movie ticket prizes for the "top performers" after the session.

To maintain confidentiality, we will use student identifiers (numbers and letters) when dealing with the data.  Each participant will be assigned a subject identifier number.  The number will not be attached to any document that includes personal identifiers (such as the informed consent form).  We will only request demographic data such as (age, sex, class rank, ethnicity).  Only group data will be analyzed and all consent forms and data will be stored under lock and key when not in use at each site.

# 6. Data Collection Summary: Australia

## *Schedule*

The study schedule for Australia,  Mayalsia and US has evolved as follows:

- The Australian group: ~100 students from the University of Sydney participated in the user study on the 18th October.
- The US group: ~160 students will participate in January 2012
- The Malaysian group: Date to be scheduled.

The Australian group's data will undergo preliminary analysis to determine whether changes need to be made with the protocol. If the new version of the tool is substantially different from the version administered in this round due to confounds or other issues, a new set of students can be canvassed from Sydney University next year to complete the new version of the user study.

Australian data collection brief stats:
- 91 subjects completed both conditions (high and low CL)
- Approximately 239 survey/response data points per subject
- Speech data: 6.5Gb = 58 hours of speech
- Interactive Behaviour: ~96 million data points including mouse trajectories, selection, typing, browsing activity (attentional focus)

## *Analysis Plan*

The hypotheses described in the earlier section of the same title have been operationalized as follows:

| H1: | Participants from a collectivistic culture (e.g.Malaysia) will rate trust higher when applicants have higher benevolence |
|---|---|
| H2: | Participants from an individualistic culture (e.g.US, Australia) will rate trust higher when applicants have higher ability |
| H3: | Participants will bin applicants with higher ability in the Supervisor category |
| H4: | Participants will bin applicants with higher benevolence in the Co-Worker category |
| H5: | Participants will bin applicants with higher integrity in the Others' Supervisor category |
| H6: | The above posited cultural effects will be greater under high cognitive load. |
| H7: | Interactive behaviours, such as speech fluency and mouse trajectories are likely to change during the high cognitive load task when compared to the low load task. |

Several analyses will be conducted. First, the survey data will be aggregated based on the pre-established scales used. Reliability analyses will be conducted to ensure that these measures are reliable. Various analysis techniques (e.g., ANOVA, regression) will be used depending on the hypothesis to be tested. Principle component analysis will be needed for the survey and questionnaire answers.

For Hypotheses 6 and 7, a number of features of interest will be extracted and annotated. The following details some of the planned feature extraction activities on each of the behavioural measures recorded.

## Speech data

1. Data cleaning (e.g. remove cross-talk, segmentation)

The speech data has been recorded in segments, which correspond to each of the three subtasks. Since the experiments took place in a classroom laboratory, a number of participants completed the sessions at the same time. Although directed microphone headsets were use, and participants were seated as far away as possible from one another, there is a chance that cross-talk has affected the speech recordings. It will be necessary to clean the data by extracting any noise or speech from other participants from the recording.

2. Build CL models, test data

Some of the data will be used to create a low load and a high load models of speech for each of the three tasks, while the rest of the data will be used to test the models. This will verify whether cognitive load can be detected from the acoustic features of speech in this application.

3. Linguistic analysis of think-aloud speech

Once the speech data is pre-processed and cleaned, mid-level features such as pause frequencies and lengths can also be annotated. Linguistic speech features can also be collected from the transcripts (which themselves can be generated automatically). Features such as frequency and type of pronoun use, sentence complexity (including sentence length and average word length), total text length, use of affective words, use of cognitive words, among other word categories.

4. Transcriptions and qualitative analysis of speech data

Finally, qualitative analysis can be useful in this instance to further understand the thought process through which the participant arrives at their response. Similarities in thought processes between questions/sub-questions, can provide more information about how trust judgments are made.

## Justification Text

The justification text will undergo linguistic analysis, including: frequency and type of pronoun use, sentence complexity (including sentence length and average word length), total text length, use of affective words, use of cognitive words, among other word categories. These features will be used for comparison purposes between the low and high load conditions.

## Mouse trajectories

Initially, a parsing tool will be built that can display each trajectory along a time scale, and allow closer inspection of movement. This will allow exploratory analysis/ inspection of mouse behaviors which are typical of this application. Some basic features that can be automatically extracted from this dataset include:

- Time spent moving mouse
- Distance traveled per task/ per session
- Categorizing time spent in different screen/window areas on a per-task basis
- Which areas of the screen were most frequented
- How much time spent on specific widgets, e.g. drop down boxes.
- Which information was looked at when answering which questions.
- Which questions were hesitated on/ Which questions they were much more decisive on
- Pauses in mouse movement indicate thinking – this will help to identify sections of high load.

While there may be a large individual differences, the trends may still indicate relative changes at different points in time during the task.

## Other interactive behaviors

Application level behaviors such as  false starts in answer selections, changes in selections, etc can also give an indication of high load instances within the session or task.

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# 8. Appendix

## *Consent Form*

UNSW

NICTA

THE UNIVERSITY OF NEW SOUTH WALES (UNSW) AND NATIONAL ICT AUSTRALIA (NICTA)

## PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM

Applicant Screening Tool

**[Participant selection and purpose of study]**
You *(i.e. the research participant)* are invited to participate in a study of a new "Applicant Screening Tool". We *(i.e. the investigators)* hope to learn to investigate how people rate applicants using a newly developed software tool. You were selected as a possible participant in this study because you are sufficiently removed from this area of expertise. A total of approximately 360 participants will be enrolled over several phases of the study.

**[Description of study and risks]**
If you decide to participate, we will ask you to interact with a computer simulation and answer questions using a computer. During this task, you will be asked to review several pieces of information for numerous applicants and rate their suitability for different roles. You will also be required to complete a few questionnaires related to the task. We will also be collecting speech data, mouse trajectories and keyboard strokes, but this should not interfere with your ability to complete the task.
We will also train you such that you are confident in completing the tasks. The training will happen at the beginning of the session and give you an opportunity to familiarise yourself with the system's functionality and the tasks to be completed.
Your participation will not involve risks or discomforts greater than you would encounter when using a computer.

**[Confidentiality and disclosure of information]**
Data will be collected from participants in the United States of America, Australia, and Malaysia. Data will be shared with the investigating researchers at each of the three data collection sites. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission, except as required by law. If you give us your permission by signing this document, we plan to publish the results in academic journals and conference proceedings, as well as to build models on features derived from the recorded behavioural signals. These models cannot be reversed to recover any of the original signals, and the models may be used for our own evaluations, as well as be used offsite by outside third parties that we would grant the permission. In any publication of results and distribution of models or related software, information will be suppressed in such a way that you cannot be identified.

**[Recompense to participants]**
You will be given course credit as part of the user study package at the completion of the study.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

**[Your consent]**
Your decision whether or not to participate will not prejudice your future relations with The University of Sydney or The University of New South Wales or National ICT Australia.    If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.
If you have any questions, please feel free to ask us.  If you have any additional questions later, Dr. Fang Chen on (02) 9376 2101 will be happy to answer them. You will be given a copy of this form to keep.

**PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM
(continued)**

Applicant Screening Tool

**You are making a decision whether or not to participate.  Your signature indicates that, having read the Participant Information Statement, you have decided to take part in the study.**


……………………………………………                        ……………………………………………..
Signature of Research Participant                              Signature of Witness


……………………………………………                        ……………………………………………..
 (Please PRINT name)                                          (Please PRINT name)


……………………………………………                        ……………………………………………..
Date                                                         Nature of Witness


……………………………………………
Signature(s) of Investigator(s)


………………………………………………..
Please PRINT Name


**REVOCATION OF CONSENT**
Applicant Screening Tool

I hereby wish to **WITHDRAW** my consent to participate in the research proposal described above and understand that such withdrawal **WILL NOT** jeopardise any treatment or my relationship with The University of New South Wales and National ICT Australia Ltd.


……………………………………………                        ……………………………………………..
Signature                                                    Date


……………………………………………
Please PRINT Name


The section for Revocation of Consent should be forwarded to Dr. Fang Chen, Locked Bag 9013, Alexandria, NSW 1435, Australia.

## *Protocol for Training Applicant Screening Tool*

Over the next 60 minutes you will be asked to complete a series of tasks.

This information will be used to evaluate a new applicant screening tool, which will be used by human resource departments and potential employers.

The design of the tool was modelled after social media websites to standardize the hiring process for positions with large number of applicants.

The tool provides employers an applicant's virtual resume and assist employers in selecting the best fitting applicants for various positions.

The tool includes several different features that may be added to the final product.

You will be asked to complete survey questions and we will record your verbal responses to better evaluate the tool and different features provided.

Please describe the steps you take and decisions you make verbally. Please also verbalize any emotional responses you have to the applicants.

A demonstration of this will be provided in a training video.

Following the training video, you will be presented with two versions of the tool with varying features. The training exercise will begin now, which will outline these features.

**Script Task 1: Rating Applicants**

This screen shot shows an overview of each applicant's virtual resume.

Each resume provides limited information of the applicant.

At the top of the screen, moving from left to right, you will see a tab for each applicant. There are three categories of information for each applicant:

education,

experience, and

volunteer experience and personal interests.

Within each of these categories is a statement about the applicant.

As part of the audio recording, please read aloud each recommendation.

For example:

After reviewing the profile and reading aloud each recommendation, you must complete the questions listed at the bottom of the screen.

You will complete this for each applicant. Use this task to familiarize you with the applicants.

After completing the questions for each of the four applicants, you will now move onto selecting the applicant for the best fitting position.

**Task 2 : Selecting Applicants into Position**

This screen shot shows a summary of the information presented in the four applicant resumes.

Use this summary page to select the applicant who is most appropriate for the position listed on the right side of the screen.

This includes:

a supervisor within your department,

a co-worker within your department,

and a supervisor for a different department.

You will not be able to select the same applicant for more than one position.

To place an applicant in a position drag and drop the resume into the appropriate slot.

Please note that you can change your response by dragging a different applicant in a previously filled slot.

Once you have selected an applicant for a position, please rate how confident you are in the decision made, which ranges from very high confidence to very low confidence.

Please remember to verbalize your actions, feelings, and thoughts throughout your decision process.

For example, you may say: <>
When you click on the continue button, a pop-up will ask you to justify your decisions.
Type in your justifications and click save.
Please provide a specific and brief explanation for your decision.

**Task 3: Ranking Applicants into Position**
In the next task, you will need to rank the participants from best to worst for the three positions.
Do this by dragging the applicants to each ranking option.
Again, you can change the order of the ranked applicants at any point before clicking the "continue" button by dragging a different applicant into the ranking slot.
When completing the ranking be sure to verbalize your actions, feelings, and thoughts.
For example, you may say: <>

**Task Summary and Scores**
Once you have finished these three tasks, you will be presented a review of your performance.
This review covers the number of applicants rated, selected, and ranked.
You are also provided feedback on your accuracy of queuing future applicants.

You will complete two full sessions of these tasks.
You will use the full version of the tool in each session, but only one session will include the queuing  and notification feature of the tool. You will be told which version you will be completing before you begin.

**Ok, lets' begin!**

**The Notification Feature**
You will evaluate two versions of the tool. One of them will have a special notification feature.
You will notice a pop-up in the bottom right of the screen as you are using the tool.
This feature indicates that new resumes have arrived and you will need to add or queue future applicants.
If a resume is listed as relevant for "Human Resources," you will need to add the resume to the queue by clicking on the box and then clicking "ADD."
If the resume is listed as relevant for a department other than "Human Resources," such as "Finance," do not add the resume to the queue.
You can exit the queue box without adding an applicant by clicking the "X" at the top of the box.
If you incorrectly add an applicant to the queue, the applicant will be highlighted red to provide you immediate feedback of your error.
You will only have 4 seconds to decide if an applicant needs to be added to the queue before this information disappears.
You will be scored on the number of applicants correctly added to the queue so be sure to carefully attend to this information when the pop-up appears.

## *Pilot Survey*

Thank you for participating in our survey. The survey will take between 15 and 20 minutes to complete. The survey is being used to develop and validate questions for a study on recommendations for job applicants. Participation is voluntary. Data will only be used for

study development purposes and no personal identification information will be recorded.

At the end of the survey, you will be asked for your student number. This is so we can organise to get your Event movie voucher to you in appreciation for your time, and your responses will remain anonymous.

If you have any questions or concerns, please contact Dr. Kevin Eschleman (kevin.eschleman@wpafb.af.mil). Thank you again for your participation.

1. Please choose the answer that best describes you.

☐  Please choose the answer that best describes you.

**Native Australian:** You were born in Australia and have lived here most of your life and identify as Australian.

☐  **Near-native Australian:** You were NOT born in Australia, but you have lived here for the majority of your life and identify as Australian.

☐  **Non-native:** You were NOT born here and you do NOT identify yourself as Australian.

2. What is the ethnicity you most closely identify with?

Rating Applicant Recommendations

In the following section, you are given a list of recommendations that will be used to describe potential employees. The recommendations are provided by coworkers, supervisors, teachers, and friends. Please identify the personal characteristic you think the recommendation describes. Your options include:

**High Ability:** The recommendation reflects the competencies and skills relevant to being a successful employee.

**High Benevolence:** The recommendation reflects that the applicant considers other people's interests before making decisions or acting.

**High Integrity:** The recommendation reflects that the applicant adheres to a set of principles and values that are considered positive.

**Neutral:** The recommendation does not strongly reflect any specifc personal characteristic.

**Other:** Mark "Other" if you believe the recommendation describes a personal characteristic that was not provided as an option.

3. This person has a strong moral foundation.

☐  Ability                                    ☐  Integrity

☐  Benevolence                               ☐  Neutral

Other (please specify) [                    ]

4. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**

5. This person is inconsistent in performance and completion of tasks.

☐  Ability                                    ☐  Integrity

☐  Benevolence                               ☐  Neutral

Other (please specify) [                    ]

6. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

7. A good employee whose technical know-how is widely regarded as state-of-the-art.

☐   Ability                        ☐ Integrity

☐   Benevolence              ☐ Neutral

Other (please specify) [_____]

8. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

9. We have known each other for about two years.

☐   Ability                        ☐ Integrity

☐   Benevolence              ☐ Neutral

Other (please specify) [_____]

10. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

11. This person has a questionable value system.

☐   Ability                        ☐ Integrity

☐   Benevolence              ☐ Neutral

Other (please specify) [_____]

12. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

13. We have similar interests.

☐   Ability                        ☐ Integrity

☐   Benevolence              ☐ Neutral

Other (please specify) [_____]

14. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

15. This person's quality of work is not adequate.

☐   Ability                        ☐ Integrity

☐   Benevolence              ☐ Neutral

Other (please specify) [_____]

16. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

17. This person always does the right thing even in morally difficult situations.

☐   Ability                        ☐ Integrity

☐   Benevolence              ☐ Neutral

Other (please specify) [_____]

18. Based on your above response...

**1 - Very Low      2 - Low          3 - Moderate      4 - High          5 - Very High**

19. This person needs to learn to consult with other team members before acting.

☐   Ability                        ☐ Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

20. Based on your above response...

**1 - Very Low        2 - Low             3 - Moderate        4 - High             5 - Very High**

21. I am surprised we have not interacted more.

☐  Ability                              ☐  Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

22. Based on your above response...

**1 - Very Low        2 - Low             3 - Moderate        4 - High             5 - Very High**

23. This person is not honest nor upfront about intentions.

☐  Ability                              ☐  Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

24. Based on your above response...

**1 - Very Low        2 - Low             3 - Moderate        4 - High             5 - Very High**

25. This person is currently an employee at our organization.

☐  Ability                              ☐  Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

26. Based on your above response...

**1 - Very Low        2 - Low             3 - Moderate        4 - High             5 - Very High**

27. Questionable ability to perform essential job tasks.

☐  Ability                              ☐  Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

28. Based on your above response...

**1 - Very Low        2 - Low             3 - Moderate        4 - High             5 - Very High**

29. Please mark integrity.

☐  Ability                              ☐  Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

30. This person enrolled in several of my courses while in school.

☐  Ability                              ☐  Integrity

☐  Benevolence                              ☐  Neutral

Other (please specify) [                    ]

31. Based on your above response...

**1 - Very Low        2 - Low             3 - Moderate        4 - High             5 - Very High**

32. This person does not meet expectations of performance in all areas.

☐  Ability                              ☐  Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

33. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

34. This person always gets things done well.

☐ Ability ☐ Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

35. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

36. This person has a tendency to ignore others.

☐ Ability ☐ Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

37. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

38. We have not had an opportunity to interact much.

☐ Ability ☐ Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

39. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

40. The work devoted to planning and organizing is always careful and complete.

☐ Ability ☐ Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

41. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

42. This person needs to improve on basic work skills.

☐ Ability ☐ Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

43. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

44. This person has been an active member of the club for several years.

☐ Ability ☐ Integrity

☐ Benevolence ☐ Neutral

Other (please specify) _____

45. Based on your above response...

**1 - Very Low   2 - Low      3 - Moderate    4 - High       5 - Very High**

46. This person is one of my most fair and impartial employees.

☐    This person is one of my most fair and impartial employees.   Ability

☐   Integrity

☐   Neutral

☐   Benevolence

Other (please specify)

47. Based on your above response...

**1 - Very Low     2 - Low      3 - Moderate    4 - High       5 - Very High**

48. This person does not demonstrate a commitment to helping others.

☐   Ability

☐   Integrity

☐   Benevolence

☐   Neutral

Other (please specify)

49. Based on your above response...

**1 - Very Low      2 - Low       3 - Moderate     4 - High        5 - Very High**

50. This person consistently demonstrated strong skills on class projects and understanding of course material.

☐   Ability

☐   Integrity

☐   Benevolence

☐   Neutral

Other (please specify)

51. Based on your above response...

**1 - Very Low     2 - Low      3 - Moderate    4 - High       5 - Very High**

52. The interests of the team and coworkers were always placed before this person's self interests.

☐   Ability

☐   Integrity

☐   Benevolence

☐   Neutral

Other (please specify)

53. Based on your above response...

**1 - Very Low     2 - Low      3 - Moderate    4 - High       5 - Very High**

54. This person is not always truthful and honest.

☐   Ability

☐   Integrity

☐   Benevolence

☐   Neutral

Other (please specify)

55. Based on your above response...

**1 - Very Low     2 - Low      3 - Moderate    4 - High       5 - Very High**

56. This person is proficient and compentent while completing work.

☐   Ability

☐   Integrity

☐   Benevolence

☐   Neutral

Other (please specify)

57. Based on your above response...

**1 - Very Low     2 - Low      3 - Moderate    4 - High       5 - Very High**

58. This person has a strong character.

☐   Ability

☐   Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

59. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

60. This person is always excited about the club.

☐ Ability                              ☐ Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

61. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

62. This person lacks consistency in values and principles.

☐ Ability                              ☐ Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

63. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

64. This person does not put in an extra effort to help others.

☐ Ability                              ☐ Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

65. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

66. This person performs quality work.

☐ Ability                              ☐ Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

67. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

68. This person has strong values that are well respected.

☐ Ability                              ☐ Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

69. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

70. This person is honest, just, and impartial without fail.

☐ Ability                              ☐ Integrity

☐ Benevolence                          ☐ Neutral

Other (please specify) [                    ]

71. Based on your above response...

**1 - Very Low       2 - Low        3 - Moderate       4 - High          5 - Very High**

72. This person consistently completed tasks at a high level.

☐  Ability                             ☐  Integrity

☐  Benevolence                         ☐  Neutral

Other (please specify) _____

73. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**


74. This person does everything possible to help out whenever possible.

☐  Ability                             ☐  Integrity

☐  Benevolence                         ☐  Neutral

Other (please specify) _____

75. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**

76. Has always been particularly good to me.

☐  Ability                             ☐  Integrity

☐  Benevolence                         ☐  Neutral

Other (please specify) _____

77. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**

78. This person takes good care of the employees.

☐  Ability                             ☐  Integrity

☐  Benevolence                         ☐  Neutral

Other (please specify) _____

79. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**

80. I was always confident the work would be completed efficiently and competently.

☐  Ability                             ☐  Integrity

☐  Benevolence                         ☐  Neutral

Other (please specify) _____

81. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**

82. This person is kind and caring toward others.

☐  Ability                             ☐  Integrity

☐  Benevolence                         ☐  Neutral

Other (please specify) _____

83. Based on your above response...

**1 - Very Low      2 - Low        3 - Moderate      4 - High          5 - Very High**

84. This person goes well above and beyond the call of duty to look out for other students' best interests.

☐  Ability                             ☐  Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

85. Based on your above response...

**1 - Very Low        2 - Low           3 - Moderate      4 - High           5 - Very High**

86. This person puts forth an extra effort to support others.

☐ Ability                                        ☐ Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

87. Based on your above response...

**1 - Very Low       2 - Low           3 - Moderate       4 - High           5 - Very High**

88. This person has been part of our team for several years.

☐ Ability                                        ☐ Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

89. Based on your above response...

**1 - Very Low       2 - Low           3 - Moderate       4 - High           5 - Very High**

90. This person is a valuable employee who performed at a high level.

☐ Ability                                        ☐ Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

91. Based on your above response...

**1 - Very Low       2 - Low           3 - Moderate       4 - High           5 - Very High**

92. This person is respectful of other people and their opinions.

☐ Ability                                        ☐ Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

93. Based on your above response...

**1 - Very Low        2 - Low            3 - Moderate       4 - High            5 - Very High**

94. This person lacks a moral center.

☐ Ability                                        ☐ Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

95. Based on your above response...

**1 - Very Low        2 - Low            3 - Moderate       4 - High            5 - Very High**

96. This person needs to become more compassionate and caring toward others.

☐ Ability                                        ☐ Integrity

☐ Benevolence                                    ☐ Neutral

Other (please specify) ☐

97. Based on your above response...

**1 - Very Low**   **2 - Low**   **3 - Moderate**   **4 - High**   **5 - Very High**

98. This person's judgement is not always ethically sound.

▢ Ability                ▢ Integrity

▢ Benevolence          ▢ Neutral

Other (please specify) [_____]

99. Based on your above response...

**1 - Very Low**   **2 - Low**   **3 - Moderate**   **4 - High**   **5 - Very High**

100. This person is very supportive of others in the workplace.

▢ Ability                ▢ Integrity

▢ Benevolence          ▢ Neutral

Other (please specify) [_____]

101. Based on your above response...

**1 - Very Low**   **2 - Low**   **3 - Moderate**   **4 - High**   **5 - Very High**

102. Please mark benevolence.

▢ Ability                ▢ Integrity

▢ Benevolence          ▢ Neutral

Other (please specify) [_____]

103. This person acts on the up and up from what I've seen and heard.

▢ Ability                ▢ Integrity

▢ Benevolence          ▢ Neutral

Other (please specify) [_____]

104. Based on your above response...

**1 - Very Low**   **2 - Low**   **3 - Moderate**   **4 - High**   **5 - Very High**

105. This person is always fair and honest.

▢ Ability                ▢ Integrity

▢ Benevolence          ▢ Neutral

Other (please specify) [_____]

106. Based on your above response...

**1 - Very Low**   **2 - Low**   **3 - Moderate**   **4 - High**   **5 - Very High**

107. This person does not tolerate or listen to others.

▢ Ability                ▢ Integrity

▢ Benevolence          ▢ Neutral

Other (please specify) [_____]

108. Based on your above response...

**1 - Very Low**   **2 - Low**   **3 - Moderate**   **4 - High**   **5 - Very High**

109. This person does not have a strong set of principles.

☐   Ability                                        ☐  Integrity

☐  Benevolence                                     ☐  Neutral

Other (please specify)

110. Based on your above response...

**1 - Very Low          2 - Low                3 - Moderate          4 - High                5 - Very High**

## *Pre - Screening Survey*

You have been offered the opportunity to participate in a cross-cultural decision making study using the "Applicant Screen Tool." The purpose of this research is to investigate how people rate applicants using a newly developed software tool. Please complete the following survey in preparation for the experiment. If you have questions or concerns regarding the survey, please contact Dr. Natalie Ruiz.

Dr. Natalie Ruiz
Natalie.Ruiz@nicta.com.au
T +61 2 9376 2160

1. Please provide your student ID (unikey). This information will be used to link your survey responses to your participation in the study.
2. The following statements describe beliefs about the world. Please indicate your agreement with each statement.

| Strongly disagree | Disagree | Neither agree or disagree | Agree | Strongly agree |
|---|---|---|---|---|
| | | | | |

An individual who is currently honest will stay honest in the future.
Any phenomenon has numerous numbers of causes, although some of the causes are not known.
Everything in the universe is somehow related to each other.
We should consider the situation a person is faced with, as well as his/her personality, in order to understand one's behavior.
Nothing is unrelated.
A person who is currently living a successful life will continue to stay successful.
Any phenomenon entails a numerous number of consequences, although some of them may not be known.
Even a small change in any element of the universe can lead to significant alterations in other elements.
The whole is greater than the sum of its parts.
Future events are predictable based on present situations.
When disagreement exists among people, they should search for ways to compromise and embrace everyone's opinions.
Everything in the world is intertwined in a causal relationship.
It is more desirable to take the middle ground than go to extremes.
Current situations can change at any time.
The whole, rather than its parts, should be considered in order to understand a phenomenon.
It is not possible to understand the parts without considering the whole picture.
If an event is moving toward a certain direction, it will continue to move toward that direction.
Every phenomenon in the world moves in predictable directions.
It is more important to pay attention to the whole than its parts.
It is more important to pay attention to the whole context rather than the details.
It is desirable to be in harmony, rather than in discord, with others of different opinions than one's own.
Choosing a middle ground in an argument should be avoided.
It is important to find a point of compromise than to debate who is right/wrong, when one's opinions conflict with other's opinions.

We should avoid going to extremes.

The following statements describe individual characteristics. Please indicate your agreement with each statement.

| Strongly disagree | Disagree | Neither agree or disagree | Agree | Strongly agree |
|---|---|---|---|---|
| | | | | |

I would prefer complex to simple problems.

I like to have the responsibility of handling a situation that requires a lot of thinking.

Thinking is not my idea of fun.

I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.

I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something.

I find satisfaction in deliberating hard and for long hours.

I only think as hard as I have to.

I prefer to think about small, daily projects to long-term ones.

I like tasks that require little thought once I've heard them.

The idea of relying on thought to make my way to the top appeals to me.

I really enjoy a task that involves coming up with new solutions to problems.

Learning new ways to think doesn't excite me very much.

I prefer my life to be filled with puzzles that I must solve.

The notion of thinking abstractly is appealing to me.

I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.

I feel relief rather than satisfaction after completing a task that required a lot of mental effort.

It's enough for me that something gets the job done; I don't care how or why it works.

I usually end up deliberating about issues even when they do not affect me personally.

Imagine yourself in a job setting and rate your agreement with the following items.

| Strongly disagree | Disagree | Neither agree or disagree | Agree | Strongly agree |
|---|---|---|---|---|
| | | | | |

It is important to have a good working relationship with your direct superior.

It is important to be consulted by your direct superior in his/her decisions.

A subordinate should not be afraid to express disagreement with his/her superior.

A structure with a subordinate having two bosses should be avoided.

People at lower levels in the organization should carry out the requests of people at higher levels without questions.

People at higher levels in organizations have a responsibility to make important decision for people below them.

Once a manager makes a decision, people working for the company should not question it.

In work-related matters, managers have a right to expect obedience from their subordinates.

An organization's rules should not be broken, not even when the employee thinks it is in the company's best interest.

Managers should make most decisions without consulting subordinates.

It is frequently necessary for a manager to use authority and power when dealing with subordinates.

Managers should seldom ask for the opinions of employees.

Employees should not disagree with management's decisions.

Managers should not delegate important tasks to employees.
Most organizations would be better off if conflict could be eliminated.
One can be a good manager without having precise answers to most of the questions that subordinates may raise about their work.
In order to have efficient work relationships, it is often necessary to bypass the hierarchical lines.
I am uneasy in situations in which there are no clear rules or guidelines.
Conflicts with our opponents are best resolved by both parties compromising a bit.

The following statements describe other people. Please indicate your agreement with each statement.

| Strongly disagree | Disagree | Neither agree or disagree | Agree | Strongly agree |
|---|---|---|---|---|

Most people are basically honest.
Most people are trustworthy.
Most people are basically good and kind.
Please identify how much the following statements describe you in general.

| Strongly disagree | Disagree | Neither agree or disagree | Agree | Strongly agree |
|---|---|---|---|---|

I am the life of the party.
I sympathize with others' feelings.
I get chores done right away.
I have frequent mood swings.
I have a vivid imagination.
I don't talk a lot.
I am not interested in other people's problems.
I often forget to put things back in their proper place.
I am relaxed most of the time.
I am not interested in abstract ideas.
I talk to a lot of different people at parties.
I feel others' emotions.
I like order.
I get upset easily.
I have difficulty understanding abstract ideas.
I keep in the background.
I am not really interested in others.
I make a mess of things.
I seldom feel blue.
I do not have a good imagination.
7. Please identify your gender/sex.

☐ Please identify your gender/sex.   Male

☐ Female

8. Please identify your school/military status.

☐ Please identify your school/military status.   College Freshman

☐ College Sophomore

☐ College Junior

☐ College Senior

☐ Military

Other (please specify)

9. Please select the response that best describes your ethnicity.

☐ Please select the response that best describes your ethnicity.   Non-native

☐ Near-native

☐ Native

Self-identified ethnicity:

10. What is your age in YEARS?

11. What is the hand you primarily use (handedness)?

○ What is the hand you primarily use (handedness)?   Right

○ Left

○ Both (ambidextrous)

12. Do you wear glasses or contact lenses to read?

○ Do you wear glasses or contact lenses to read?   Yes

○ No

13. Have you ever been involved in hiring or human resources?

○ Have you ever been involved in hiring or human resources?   Yes

○ No

## *Debriefing and Student Exercise*

INFO3315 - Experiment 2 In-Class Exercise
HR Applicant Screening Tool

<u>Debriefing</u>

Trust is a critical variable in military operations, be it trust in leadership and team members or between opposing sides at the negotiation table. The purpose of this study is to examine the trust process across cultures and establish a fundamental understanding of how trust operates. The three data collection venues include: the U.S. (Wright State University), Malaysia (Sunway University), and Australia (NICTA)
The process of a trust judgement has both affective and cognitive components.

The HR applicant screening tool was a "cover story" in order to get samples of people making trust judgements based on 3 aspects: Benevolence, Integrity and Ability. The applicant's details were manipulated along these 3 variables. In the experiment you participated in (the "Australian" group), the cognitive load was also manipulated using a "dual task" design (The Notification Feature). This was an attempt to disrupt the trust judgement by overloading the "cognitive" processing and forcing subjects to use more "affective" processes to make the judgements. This would either change the applicant you trust the most, or not, and would give us a better idea on how people make trust judgements.

<u>Methodology</u>

1. In this testing experiment, all participants completed both versions of the software, with and without the notification feature.
a) What is this kind of design called?
b) What are the expected benefits of this design type?
c) A rank order effect may be observed in this experiment design. What is it and how can it be counteracted?

2. As a tester, you were asked to think-aloud while completing this experiment. What kind of information can we get from thinking-aloud protocols?

<u>UI Design and Implementation</u>

3. The tabbed pane widget used to display the applicant profiles and question panels cannot be used for navigation (to switch from one tab to another). Instead, the user is prompted to click "Continue" to progress within the task, and from profile to profile.

a) Cite at least one benefit of using this specific design combination.

b) What is its major drawback?

4. The application designers wanted to highlight some specific sections of the applicants' profiles. Cite 2 ways in which they tried to achieve this.

5. What other interaction patterns could have been used instead of radio buttons to record the answers to each review question?

Task 2: Fill positions and Task 3: Rank applicants

6. The layout of this panel changed from the previous task panels. Some interface features changed and some others stayed the same. Why do you think that was done?

7. The drag and drop mechanism allowed easy placement of the applicants into the ranking slots. Sketch a wireframe of an alternative mechanism that could be used to achieve the same goal of ranking the applicants.

8. The dialogue box to "Justify your decisions" popped up once your selections were made, which was not a good way to solicit feedback about the rankings. Give 2 ways in which it could have been done better.

Notification Feature

9. The notification feature allows incoming applicants to be sorted as they come in, at the same time as reviewing applicants. This avoids a build up of new applicants that need to be sorted through later.



a) What interface and interaction aspects of this feature worked well? (Name one)

b) What are the limitations of this implementation of the feature? (Name one)

c) How can these be overcome?

*Training Video Storyboard*

-50-

*Training Video Storyboard*

# Applicant Screening Tool

## User Testing

# Task 1: Rating Applicants





# Task 2: Selecting Applicants into Position

# The Notification Feature







# Task Summary and Scores

## Task Review:

**Rating Applicants**
Number of Applicants that were rated: 4 of 4 (100%)

**Position Selection**
Number of positions filled: 3 of 3 (100%)

**Ranking**
Number of Applicants Ranked: 4 of 4 (100%)
Number of Positions Ranked:  3 of 3 (100%)

**Future Tasks Queued (Not Used In This Session)**

| | |
|---|---|
| Applicants added for Human Resource Manager: | Not Used In This Session |
| Incorrectly added applicants: | Not Used In This Session |

Thank you for ranking the applicants.

Please click continue when you are ready to take some surveys.

Continue

## Let's Begin!